IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
REQUEST FOR FILING NATIONAL PHASE OF
PCT APPLICATION UNDER 35 U.S.C. 371 AND 37 CFR 1.494 OR 1.495

To: Hon. Commissioner of Patents
Washington, D.C. 20231

00909

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US)

Atty Dkt: P 290586 /SET9902PCT/US
M# /Client Ref.

From: Pillsbury Winthrop LLP, IP Group:

Date: February 21, 2002

This is a **REQUEST** for **FILING** a PCT/USA National Phase Application based on:

1. International Application	2. International Filing Date	3. Earliest Priority Date Claimed
PCT/EP00/07381	31 July 2000	21 August 1999
⇧ country code	Day MONTH Year	Day MONTH Year
		(use item 2 if no earlier priority)

4. Measured from the earliest priority date in item 3, this PCT/USA National Phase Application Request is being filed within:

(a) ☐ 20 months from above item 3 date (b) ☒ 30 months from above item 3 date,

(c) Therefore, the due date (unextendable) is February 21, 2002

5. Title of Invention HOT-MELT RESINS AND THEIR USE

6. Inventor(s) Rainer BLUM
Manfred EICHORST
Günther HEGEMANN
Klaus-Wilhelm LIENERT

Applicant herewith submits the following under 35 U.S.C. 371 to effect filing:

7. ☒ Please immediately start national examination procedures (35 U.S.C. 371 (f)).

8. ☐ **A copy of the International Application** as filed (35 U.S.C. 371(c)(2)) is transmitted herewith (file if in English but, if in foreign language, file only if not transmitted to PTO by the International Bureau) including:

a. ☐ Request;
b. ☐ Abstract;
c. ___ pgs. Spec. and Claims;
d. ___ sheet(s) Drawing which are ☐ informal ☐ formal of size ☐ A4 ☐ 11"

9. ☒ **A copy of the International Application has been transmitted by the International Bureau.**

10. **A translation of the International Application** into English (35 U.S.C. 371(c)(2))
a. ☒ is transmitted herewith including: (1) ☐ Request; (2) ☒ Abstract;
(3) 30 pgs. Spec. and Claims;
(4) _____ sheet(s) Drawing which are:
☐ informal ☐ formal of size ☐ A4 ☐ 11"
b. ☐ is not required, as the application was filed in English.
c. ☐ is not herewith, but will be filed when required by the forthcoming PTO Missing Requirements Notice per Rule 494(c) if box 4(a) is X'd or Rule 495(c) if box 4(b) is X'd.
d ☐ Translation verification attached (not required now).

RE: USA National Phase Filing of PCT /EP00/07381

11. ☒ Please see the attached Preliminary Amendment

12. ☐ Amendments to the claims of the International Application **under PCT Article 19 (35 U.S.C. 371(c)(3)), i.e., before 18th month from first priority date above in item 3, are transmitted herewith (file only if in English) including:**

13. ☒ PCT Article 19 claim amendments (if any) have been transmitted by the International Bureau

14. ☐ Translation of the amendments to the claims **under PCT Article 19 (35 U.S.C. 371(c)(3)), i.e., of claim amendments** made before 18th month, **is attached (required by 20th month from the date in item 3 if box 4(a) above is X'd, or 30th month if box 4(b) is X'd, or else amendments will be considered canceled).**

15. **A declaration of the inventor** (35 U.S.C. 371(c)(4))
a. ☐ is submitted herewith ☐ Original ☐ Facsimile/Copy
b. ☒ is not herewith, but will be filed when required by the forthcoming PTO Missing Requirements Notice per Rule 494(c) if box 4(a) is X'd or Rule 495(c) if box 4(b) is X'd.

16. **An International Search Report (ISR):**
a. Was prepared by ☒ European Patent Office ☐ Japanese Patent Office ☐ Other
b. ☒ has been transmitted by the international Bureau to PTO.
c. ☐ copy herewith (__ pg(s).) ☐ plus Annex of family members (__ pg(s).).

17. **International Preliminary Examination Report** (IPER):
a. ☒ has been transmitted (if this letter is filed after 28 months from date in item 3) in English by the International Bureau with Annexes (if any) in original language.
b. ☐ copy herewith in English.
c.1 ☐ IPER Annex(es) in original language ("Annexes" are amendments made to claims/spec/drawings during Examination) including attached amended:
c.2 ☐ Specification/claim pages #___ claims #
Dwg Sheets #
d. ☐ Translation of Annex(es) to IPER **(required by 30th month due date, or else annexed amendments will be considered canceled).**

18. **Information Disclosure Statement** including:
a. ☒ Attached Form PTO-1449 listing documents
b. ☒ Attached copies of documents listed on Form PTO-1449
c. ☒ A concise explanation of relevance of ISR references is given in the ISR.

19. ☐ **Assignment** document and Cover Sheet for recording are attached. Please mail the recorded assignment document back to the person whose signature, name and address appear at the end of this letter.

20. ☐ Copy of Power to IA agent.

21. ☐ **Drawings** (complete only if 8d or 10a(4) not completed): __ sheet(s) per set: ☐ 1 set informal; ☐ Formal of size ☐ A4 ☐ 11"

22. Small Entity Status ☒ is **Not** claimed ☐ is claimed (pre-filing confirmation required)
22(a) ___ (No.) Small Entity Statement(s) enclosed (since 9/8/00 Small Entity Statements(s) not essential to make claim)

23. **Priority** is hereby claimed under 35 U.S.C. 119/365 based on the priority claim and the certified copy, both filed in the International Application during the international stage based on the filing in (country) Germany of:

	Application No.	Filing Date		Application No.	Filing Date
(1)	19939759.7	August 21, 1999	(2)		
(3)			(4)		
(5)			(6)		

a. ☒ See Form PCT/IB/304 sent to US/DO with copy of priority documents. If copy has not been received, please proceed promptly to obtain same from the IB.
b. ☐ Copy of Form PCT/IB/304 attached.

RE: USA National Phase Filing of PCT/EP00/07381

JC13 Rec'd PCT/PTO 21 FEB 2002

24. Attached:

25 Per Item 17.c2, **cancel original** pages #___, claims #___, Drawing Sheets #

26. **Calculation of the U.S. National Fee (35 U.S.C. 371 (c)(1)) and other fees is as follows:**
Based on amended claim(s) per above item(s) ☐ 12, ☐ 14, ☐ 17, ☐ 25 (hilite)

Total Effective Claims	23	minus 20 =	3	x $18/$9	=	$54	966/967
Independent Claims	2	minus 3 =	0	x $84/$42	=	$0	964/965
If any proper (ignore improper) Multiple Dependent claim is present,				add$280/$140		+0	968/969

BASIC NATIONAL FEE (37 CFR 1.492(a)(1)-(4)): →→ **BASIC FEE REQUIRED, NOW** →→→→

A. If country code letters in item 1 are **not** "US","BR","BB","TT","MX","IL" "NZ", "IN" or "ZA"

See item 16 re:

1. Search Report was not prepared by EPO or JPO - - - - - - - - - add$1,040/$520 960/961
2. Search Report was prepared by EPO or JPO - - - - - - - - - - - - add$890/$445 +890 970/971

SKIP B, C, D AND E UNLESS country code letters in item 1 are "US","BR","BB","TT","MX","IL", "NZ", "IN", "ZA", "LC" or "PH"

→ (X)	☐	B.	If USPTO did not issue both International Search Report (ISR) and (if box 4(b) above is X'd) the International Examination Report (IPER), -	add$1,040/$520	+0 960/961
(only) (one)→ (of)	☐	C.	If USPTO issued ISR but not IPER (or box 4(a) above is X'd), -	add$740/$370	+0 958/959
(these) (4)→ (boxes)	☐	D.	If USPTO issued IPER but IPER Sec. V boxes not all 3 YES, -	add$710/$355	+0 956/957
→	☐	E.	If international preliminary examination fee was paid to USPTO and Rules 492(a)(4) and 496(b) satisfied (in IPER Sec. V all 3 boxes must be YES for all claims), - -	add $100/$50	+0 962/963

27. **SUBTOTAL =** $944

28. If Assignment box 19 above is X'd, add Assignment Recording fee of ----$40 +0 (581)

29. If box 15a is x'd, determine whether inventorship on Declaration is different than in international stage. If yes, add (per Rule 497(d) ----$130 +0 (098)

30. Attached is a check to cover the - **TOTAL FEES** $944

Our Deposit Account No. 03-3975
Our Order No. 07376 (C#) | 290586 (M#)

00909

CHARGE STATEMENT: The Commissioner is hereby authorized to charge any fee specifically authorized hereafter, or any missing or insufficient fee(s) filed, or asserted to be filed, or which should have been filed herewith or concerning any paper filed hereafter, and which may be required under Rules 16-18 and 492 (missing or insufficient fee only) now or hereafter relative to this application and the resulting Official document under Rule 20, or credit any overpayment, to our Account/Order Nos. shown above for which purpose a duplicate copy of this sheet is attached.
This CHARGE STATEMENT does not authorize charge of the issue fee until/unless an issue fee transmittal form is filed

Pillsbury Winthrop LLP
Intellectual Property Group

By Atty: Adam R. Hess **Reg. No.** 41835

Sig: Carlos Cotrone 48,715 **Fax:** (703) 905-2500
Tel: (703) 905-2089

Atty/Sec: ARH/WDW:cdw

NOTE: File in duplicate with 2 postcard receipts (PAT-103) & attachments.

APPLICATION UNDER UNITED STATES PATENT LAWS

Atty. Dkt. No. PW 290586
(M#)

Invention: HOT-MELT RESINS AND THEIR USE

Inventor (s): Rainer BLUM
Manfred EICHORST
Günther HEGEMANN
Klaus-Wilhelm LIENERT

00909
Pillsbury Winthrop LLP

This is a:

- ☐ Provisional Application
- ☐ Regular Utility Application
- ☐ Continuing Application
  - ☒ The contents of the parent are incorporated by reference
- ☒ PCT National Phase Application
- ☐ Design Application
- ☐ Reissue Application
- ☐ Plant Application
- ☐ Substitute Specification
  Sub. Spec Filed _____
  in App. No. _____ /
- ☐ Marked up Specification re
  Sub. Spec. filed _____
  In App. No _____ /

SPECIFICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re PATENT APPLICATION of:

BLUM et al.

Group Art Unit: TBA

Application No.: TBA

Examiner: TBA

Filed: February 21, 2002

FOR: HOT-MELT RESINS AND THEIR USE

* * * * * *

February 21, 2002

PRELIMINARY AMENDMENT

Hon. Commissioner of Patents
Washington, D.C. 20231

Sir:

Prior to examination on the merits, please amend the above-identified patent in the manner set forth below.

IN THE SPECIFICATION:

At the top of the first page, just under the title, insert

--This application is the National Phase of International Application PCT/EP00/07381 filed July 31, 2000, which designated the U.S. The PCT application is hereby incorporated in its entirety by reference. --

IN THE CLAIMS:

Please amend the claims as follows:

1. (Amended) Hot-melt resins comprising

A) at least one solid unsaturated polyester and

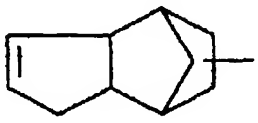
B) at least one oligomeric and/or polymeric crosslinking agent which is copolymerizable with the said polyester and which in respect of the oligomeric and/or polymeric main chain comprises at least one terminal and/or pendant propenyl, isopropenyl and/or (meth)acrylic ester group.

2. (Amended) The hot-melt resins as claimed in claim 1, wherein the crosslinking agents (B) have at least two terminal and/or pendant propenyl, isopropenyl and/or (meth) acrylic ester groups.

3. (Amended) The hot-melt resins as claimed in claim 1, wherein the crosslinking agents (B) have propenyl and/or isopropenyl groups.

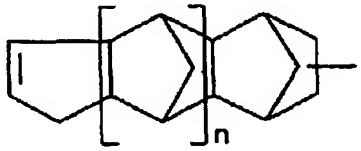
4. (Amended) The hot-melt resins as claimed in claim 1, wherein the oligomer and polymer main chains are formed by saturated and/or unsaturated polyesters, polyester amides, polyester amides and/or polyurethanes.

5. (Amended) The hot-melt resins as claimed in claim 1, wherein at least one of the unsaturated polyesters (A) and/or at least one of the crosslinking agents (B) has at least one structural unit of the general formula I



(I)

and/or at least one structural unit of the general formula II



(II) in which the index n is an integer from 1 to 10.

6. (Amended) The hot-melt resins as claimed in claim 1, wherein they comprise

additives, especially curing accelerators, photoinitiators, especially of Norrish type 1 or 2, pigments and/or fillers.

7. (Amended) The hot-melt resins as claimed in claim 6, wherein the photoinitiators are bonded chemically to at least one of the unsaturated polyesters (A) and/or at least one of the crosslinking agents (B) .

8. (Amended) The use of the hot-melt resins as claimed in claim 1 as casting and impregnating compositions or coating materials.

9. (Amended) The use of the hot-melt resins as claimed in claim 8, wherein they are used as casting and impregnating compositions for components and for impregnating absorbent materials and also as coating materials for primed and unprimed substrates.

10. (Amended) The use of the hot-melt resins as claimed in claim 9, wherein the components comprise electronic components, the absorbent materials comprise sheetlike insulating materials, especially glass silk and mica tapes, and the primed and unprimed substrates comprise vehicle body parts, industrial components or packaging, especially of metal and/or plastic.

11. (Amended) A process for the melt impregnation or melt coating of components, absorbent materials or primed and unprimed substrates comprising

(i) melt-applying a hot-melt resin,

(ii) applying the resultant resin melt onto and into the components, absorbent materials or primed or unprimed substrates,

(iii) curing the applied resin melt by heat and/or actinic radiation,

wherein the hot-melt resin comprises

A) at least one solid unsaturated polyester and

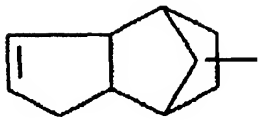
B) at least one oligomeric and/or polymeric crosslinking agent which is copolymerizable with the said polyester and which in respect of the oligomeric and/or polymeric main chain comprises at least one terminal and/or pendant propenyl, isopropenyl and/or (meth)acrylic ester group.

12. (Amended) The process as claimed in claim 12, wherein the crosslinking agents (B) have at least two terminal and/or pendant propenyl, isopropenyl and/or (meth)acrylic ester groups.

13. (Amended) The process as claimed in claim 11, wherein the crosslinking agents (B) have propenyl and/or isopropenyl groups.

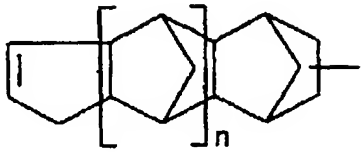
14. (Amended) The process as claimed in claim 11, wherein the oligomer and polymer main chains are formed by linear, branched and/or dendrimeric, saturated and/or unsaturated polyesters, polyester amides, polyester amides and/or polyurethanes.

15. (Amended) The process as claimed in claim 11, wherein at least one of the unsaturated polyesters (A) and/or at least one of the crosslinking agents (B) has at least one structural unit of the general formula I



(I)

and/or at least one structural unit of the general formula II



(II) in which the index n is an integer from 1 to 10.

16. (Amended) The process as claimed in claim 11, wherein they comprise additives, especially curing accelerators, photoinitiators, especially of Norrish type 1 or 2, pigments and/or fillers.

17. (Amended) The process as claimed in claim 16, wherein the photoinitiators are bonded chemically to at least one of the unsaturated polyesters (A) and/or at least one of the crosslinking agents (B).

18. (Amended) The process as claimed in claim 11, wherein the application (ii) takes place by

placing at least one shaped part comprising the hot-melt resin and adapted in its shape to the shape of the component, absorbent material or primed and unprimed substrate to be coated onto the component, absorbent material or primed and unprimed substrate, and melting the shaped part,

or by

dipping, hot-dipping, dip-rolling, flooding, casting, vacuum impregnation, vacuum pressure impregnation or trickling.

19. (Amended) The process as claimed in claim 11, wherein the applied hot-melt resin is partially gelled (process step iv) before process step (iii).

20. (Amended) The process as claimed in claim 11, wherein the applied hot-melt resin

in process step (iii) is cured by thermal curing by means of electricity, induction, hot fluids, especially hot gases, microwave radiation and/or IR radiation, especially near infrared (NIR) radiation.

21. (Amended) The process as claimed in claim 11, wherein the applied hot-melt resin in process step (iii) is cured electromagnetic radiation, especially UV radiation, and/or corpuscular radiation, especially electron beams.

22. (Amended) Components, especially electrical components, sheetlike insulating materials based on absorbent materials, and primed and unprimed substrates comprising at least one hot-melt resin, cured thermally and/or with actinic radiation, as claimed in claim 1.

23. (Amended) The components, especially the electronic components, the sheetlike insulating materials based on absorbent materials and the primed and unprimed substrates as claimed in claim 22, wherein the hot-melt resins have been applied and cured with the aid of the process as claimed in one of claims 11 to 21.

BLUM – Filed February 21, 2002

REMARKS

After introduction of the amendment set forth above, claims 1-23 will be pending in the application of which claims 1 and 11 are independent. Claims 1-23 have been amended, inter alia, to eliminate multiple dependency of the claims. Support for the above amendments can be found throughout the original application as filed. Applicants submit that no new matter has been introduced by the amendment.

Respectfully submitted,

PILLSBURY WINTHROP, LLP

By: Carlo Cotrone 48,715
for Adam R. Hess
Reg. No. 41,835
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1600 Tysons Boulevard
McLean, VA 22102
(703) 905-2000

Enclosure: Appendix

APPENDIX

VERSION WITH MARKINGS SHOWING CHANGES MADE

IN THE CLAIMS:

The claims are amended as follows:

1. (Amended) Hot-melt resins comprising

A) at least one solid unsaturated polyester and

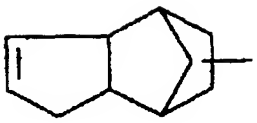
B) at least one oligomeric and/or polymeric crosslinking agent which is copolymerizable with the said polyester and which in respect of the oligomeric and/or polymeric main chain comprises at least one terminal and/or pendant propenyl, isopropenyl and/or (meth)acrylic ester group.

2. (Amended) The hot-melt resins as claimed in claim 1, [characterized in that] wherein the crosslinking agents (B) have at least two terminal and/or pendant propenyl, isopropenyl and/or (meth) acrylic ester groups.

3. (Amended) The hot-melt resins as claimed in claim 1 [or 2], [characterized in that] wherein the crosslinking agents (B) have propenyl and/or isopropenyl groups.

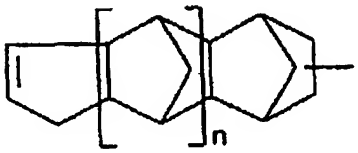
4. (Amended) The hot-melt resins as claimed in [one of claims 1 to 3] claim 1, [characterized in that] wherein the oligomer and polymer main chains are formed by saturated and/or unsaturated polyesters, polyester amides, polyester amides and/or polyurethanes.

5. (Amended) The hot-melt resins as claimed in [one of claims 1 to 4] claim 1, [characterized in that] wherein at least one of the unsaturated polyesters (A) and/or at least one of the crosslinking agents (B) has at least one structural unit of the general formula I



(I)

and/or at least one structural unit of the general formula II



(II) in which the index n is an integer from 1 to 10.

6. (Amended) The hot-melt resins as claimed in [one of claims 1 to 5] claim 1, [characterized in that] wherein they comprise additives, especially curing accelerators, photoinitiators, especially of Norrish type 1 or 2, pigments and/or fillers.

7. (Amended) The hot-melt resins as claimed in claim 6, [characterized in that] wherein the photoinitiators are bonded chemically to at least one of the unsaturated polyesters (A) and/or at least one of the crosslinking agents (B) .

8. (Amended) The use of the hot-melt resins as claimed in [one of claims 1 to 7] claim 1 as casting and impregnating compositions or coating materials.

9. (Amended) The use of the hot-melt resins as claimed in claim 8, [characterized in that] wherein they are used as casting and impregnating compositions for components and for impregnating absorbent materials and also as coating materials for primed and unprimed substrates.

10. (Amended) The use of the hot-melt resins as claimed in claim 9, [characterized in that] wherein the components comprise electronic components, the absorbent materials comprise sheetlike insulating materials, especially glass silk and mica tapes, and the primed

and unprimed substrates comprise vehicle body parts, industrial components or packaging, especially of metal and/or plastic.

11. (Amended) A process for the melt impregnation or melt coating of components, absorbent materials or primed and unprimed substrates [by] comprising

(i) melt-applying a hot-melt resin,

(ii) applying the resultant resin melt onto and into the components, absorbent materials or primed or unprimed substrates,

(iii) curing the applied resin melt by heat and/or actinic radiation,

[characterized in that] wherein the hot-melt resin comprises

A) at least one solid unsaturated polyester and

B) at least one oligomeric and/or polymeric crosslinking agent which is copolymerizable with the said polyester and which in respect of the oligomeric and/or polymeric main chain comprises at least one terminal and/or pendant propenyl, isopropenyl and/or (meth)acrylic ester group.

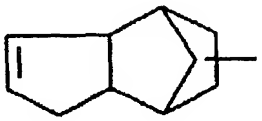
12. (Amended) The process as claimed in claim 12, [characterized in that] wherein the crosslinking agents (B) have at least two terminal and/or pendant propenyl, isopropenyl and/or (meth)acrylic ester groups.

13. (Amended) The process as claimed in claim 11 [or 12], [characterized in that] wherein the crosslinking agents (B) have propenyl and/or isopropenyl groups.

14. (Amended) The process as claimed in [one of claims 11 to 13] claim 11, [characterized in that] wherein the oligomer and polymer main chains are formed by linear,

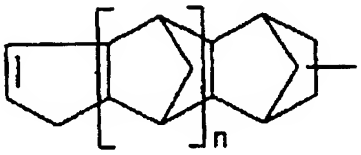
branched and/or dendrimeric, saturated and/or unsaturated polyesters, polyester amides, polyester amides and/or polyurethanes.

15. (Amended) The process as claimed in [one of claims 11 to 14] claim 11, [characterized in that] wherein at least one of the unsaturated polyesters (A) and/or at least one of the crosslinking agents (B) has at least one structural unit of the general formula I



(I)

and/or at least one structural unit of the general formula II



(II) in which the index n is an integer from 1 to 10.

16. (Amended) The process as claimed in [one of claims 11 to 15] claim 11, [characterized in that] wherein they comprise additives, especially curing accelerators, photoinitiators, especially of Norrish type 1 or 2, pigments and/or fillers.

17. (Amended) The process as claimed in claim 16, [characterized in that] wherein the photoinitiators are bonded chemically to at least one of the unsaturated polyesters (A) and/or at least one of the crosslinking agents (B).

18. (Amended) The process as claimed in [one of claims 11 to 17] claim 11, [characterized in that] wherein the application (ii) takes place by

placing at least one shaped part comprising the hot-melt resin and adapted in its shape to the shape of the component, absorbent material or primed and unprimed substrate to be coated onto the component, absorbent material or primed and unprimed substrate, and melting the shaped part,

or by

dipping, hot-dipping, dip-rolling, flooding, casting, vacuum impregnation, vacuum pressure impregnation or trickling.

19. (Amended) The process as claimed in [one of claims 11 to 18] claim 11, [characterized in that] wherein the applied hot-melt resin is partially gelled (process step iv) before process step (iii).

20. (Amended) The process as claimed in [one of claims 11 to 19] claim 11, [characterized in that] wherein the applied hot-melt resin in process step (iii) is cured by thermal curing by means of electricity, induction, hot fluids, especially hot gases, microwave radiation and/or IR radiation, especially near infrared (NIR) radiation.

21. (Amended) The process as claimed in [one of claims 11 to 20] claim 11, [characterized in that] wherein the applied hot-melt resin in process step (iii) is cured electromagnetic radiation, especially UV radiation, and/or corpuscular radiation, especially electron beams.

22. (Amended) Components, especially electrical components, sheetlike insulating materials based on absorbent materials, and primed and unprimed substrates comprising at least one hot-melt resin, cured thermally and/or with actinic radiation, as claimed in [one of claims 1 to 10] claim 1.

23. (Amended) The components, especially the electronic components, the sheetlike insulating materials based on absorbent materials and the primed and unprimed substrates as claimed in claim 22, [characterized in that] wherein the hot-melt resins have been applied and cured with the aid of the process as claimed in one of claims 11 to 21.

Hot-melt resins and their use

The invention relates to hot-melt resins based on unsaturated polyesters and to the use of these hot-melt resins as casting and impregnating compositions or coating materials.

Casting and impregnating compositions are hot-melt resins which are employed in particular in electrical engineering in accordance with techniques which are general knowledge, such as dipping, hot-dipping, dip-rolling, flooding, casting, vacuum impregnation, vacuum pressure impregnation or trickling for impregnating windings of electronic components.

The hot-melt resins are also suitable for impregnating absorbent materials such as carrier materials for sheetlike insulating materials, especially glass silk or mica tapes. In such applications, curing may be interrupted at the B stage, to give curable prepregs.

Moreover, the hot-melt resins may be used as coating materials for primed or unprimed substrates such as vehicle body parts, industrial components or packaging, especially metal and/or plastics substrates.

Not least, the hot-melt resins may be used to produce an abrasion protection for high-speed machine parts.

Mainly, however, the hot-melt resins are used as casting and impregnating compositions for electrical and electronic components.

The majority of known casting and impregnating compositions for electrical components such as motor windings or transformer windings are liquid formulations based on unsaturated polyesters, which are in solution in compounds containing vinylic and/or allylic unsaturation, such as styrene, (alpha-methylstyrene, vinyltoluene, allyl phthalates and monomeric or oligomeric acrylic or vinyl esters. Also known, furthermore, are liquid compositions based on

dicyclopentadienyl(DCPD)-modified unsaturated polyester resins, which can be cured without additional liquid and/or solid comonomers.

A disadvantage of these known casting and impregnating compositions is the use of the abovementioned monomers, which are vital for establishing the required, relatively low processing viscosities and for the curing of the unsaturated polyester resins. These monomers are injurious to health and irritant to skin. In the case of known applications of casting and impregnating compositions comprising these substances, moreover, there are mass losses of from 20 to 30%. These considerable amounts must be removed from the workplace in order to avoid health hazards for the employees. The evaporated amounts, drawn off under suction, are generally disposed of in waste-air incinerators. This gives rise to unwanted emissions. Moreover, the incineration of such quantities of material is uneconomic. Furthermore, there is a risk of these monomers not being incorporated completely in the course of curing. Residual monomers in the cured compositions may emerge, especially from electrical insulating compositions, which tend to become warm during use, and may lead to odor nuisance and health hazards. They may also gradually aftercure within the molding compounds, so undesirably altering the service properties of the said compounds.

A considerable technical problem with all liquid casting and impregnating compositions, including those curable without monomers, is the deficient storage stability of the formulations made ready for use by the addition of catalysts. In transit, especially at summer temperatures, there is always the risk of unwanted premature reactions, ranging from partial gelling to complete reaction, which is dangerous.

For these reasons, there have already been a number of attempts to use solid resins as casting and impregnating compositions. Using such hot-melt resins, it ought to be possible to reduce markedly the emissions and to improve the storage stability.

European Patent EP-A-0 101 585 proposes casting and impregnating compositions of high thermal stability and heat distortion resistance which comprise unsaturated polyesters modified with dicyclopentadiene and/or other 1,3-diolefins and as their alcohol component comprise N-hydroxyalkylimides of mono-unsaturated, unsubstituted or substituted, cyclo-aliphatic 1,2-dicarboxylic acids. The resins are processed as solutions in styrene, for example.

European Patent EP-A-0 118 786 discloses casting and impregnating compositions comprising unsaturated polyester resins which may have been modified with dicyclopentadiene, which contain cyclopentene or cyclohexene groups, and which are prepared in a complex process conducted preferably in two stages. Curing is effected at temperatures above 200°C in the presence of free-radical initiators which decompose above 140°C, or by irradiation with electron beams. The casting and impregnating compositions are processed as solutions in styrene, for example.

European Patent EP-A-0 260 688 avoids the disadvantages of the high curing temperatures of EP-A-0 118 786, of more than 200°C, by means of a modified two-stage process in which the high temperatures of the aftercure in the second stage are reduced to 120 - 200°C through the use of a specific selection of free-radical initiators.

Japanese laid-open specification JP-A-53 05 97 91 describes polyesterimide resins which are prepared using at least tribasic carboxylic acids, polyester polyols and amines. These substances are used as thermoplastic hot-melt resins for electrical insulation.

German Patents DE-A-26 48 351 and DE-A-26 48 352 relate to injection-moldable compositions which comprise unsaturated polyester resins, peroxides and fillers and are suitable for use as hot-melt resins for electrical insulation.

German Patent DE-A-16 40 428 describes the use of component-specific, ring-shaped elements made from unsaturated polyester resins, which to improve the blocking resistance are coated with waxes. These rings are placed on the winding head of the components and melted by heating, after which the resin, in the amount controlled by the ring size, flows into the components, where it cures thermally. In this process, the use of wax is required in order to ensure that the resins, which are not blocking-resistant, are storable, despite the fact that the waxes disrupt the process.

The solution proposed by German Patent DE-A-195 42 564 to the problem is to use free-radically curable resin systems comprising unsaturated polyester resins, appropriate curing agents (catalysts), if desired, comonomers and/or ethylenically unsaturated polymers such as diallyl phthalate oligomers, with or without further customary additives.

Despite the advantages of the hot-melt resins in their use as casting and impregnating compositions, and the abovementioned efforts at developing appropriate materials, no applications have been disclosed to date.

A particular problem which has been found for application is the incorporation of the free-radical initiators (e.g., peroxides) into the melts at relatively high temperatures during the formulation of the hot-melt resins. Moreover, it is difficult to incorporate the hot-melt resins into the components by melting without initiating a crosslinking reaction. With the hot-melt resins proposed to date, the stability window between processing temperature and

reaction temperature is too small for reliable handling.

The object of the present invention is to provide new hot-melt resin from which the above-described disadvantages of the prior art are now absent and which instead have a sufficiently low melt viscosity for processing even at relatively low melt temperatures and whose crosslinking does not begin until markedly above the melting temperature but is then very rapid. The new hot-melt resins are required to exhibit excellent storage stability even at an elevated ambient temperature, to cure with virtually no emissions, and, in the cured state, to display excellent thermal stability, heat distortion resistance and electrical insulation properties.

Accordingly, we have found the novel hot-melt resins comprising

A) at least one solid unsaturated polyester and

B) at least one oligomeric and/or polymeric crosslinking agent which is copolymerizable with the said polyester and which in respect of the oligomeric and/or polymeric main chain comprises at least one terminal and/or pendant propenyl, isopropenyl and/or (meth)acrylic ester group.

In the text below, the novel hot-melt resins are referred to as "hot-melt resins of the invention".

We have also found the novel uses of the hot-melt resins of the invention as casting and impregnating compositions and as coating materials.

In the text below, the novel uses are referred to collectively as "use in accordance with the invention".

In addition, we have found the novel process for the melt impregnation or melt coating of

components, absorbent materials or primed and unprimed substrates by

(i) melt-applying a hot-melt resin,

(ii) applying the resultant resin melt onto and into the components, absorbent materials or primed or unprimed substrates,

(iii) curing the applied resin melt by heat and/or actinic radiation,

which is characterized in that the hot-melt resin used comprises the hot-melt resin of the invention.

In the text below, the novel process for the melt impregnation or melt coating of components, absorbent materials or primed and unprimed substrates is referred to for short as "process of the invention".

Last but not least, we have found novel components, especially electrical components, sheetlike insulating materials based on absorbent materials, and primed and unprimed substrates, all of which comprise at least one hot-melt resin of the invention cured thermally and/or with actinic radiation.

In the text below, these articles are referred to respectively as "components of the invention", "insulating materials of the invention", "substrates of the invention" or, collectively, as "articles of the invention".

In the light of the prior art it was surprising and unforseeable for the person skilled in the art that the complex problem on which the present invention is based might be solved with the aid of the hot-melt resins of the invention. Surprisingly, the hot-melt resins of the invention melt at relatively low temperatures and have a low melt viscosity, so that a formulation in the melt with free-radical initiators and further auxiliaries can be accomplished rapidly and

gently. In the form of compositions catalyzed ready for use, the hot-melt resins have a sufficiently large processing time window for remelting and for application/incorporation onto and into the component, the absorbent material and the primed or unprimed substrate and cure outstandingly by means of heat and/or actinic radiation, such as UV light or electron beams, at a critical temperature which lies well above the melting temperature. Another great advantage is that they exhibit extremely low mass losses on processing. Consequently, hot-melt resins are provided which can be used without the solid, vinylically unsaturated reactive diluents proposed, for example, in German Patent DE-A-195 42 564. In principle, however, it is technically possible to use further solid or liquid, especially solid, ethylenically unsaturated compounds that are coreactive with the unsaturated polyesters (A) for use in accordance with the invention and with the crosslinking agents (B) for use in accordance with the invention, as reactive diluents in minor amounts. Moreover, it was surprising that the hot-melt resins of the invention may be employed with advantage in other technological fields as well, such as in the production of sheetlike insulating materials by melt impregnation or in the production of coated vehicle body parts, industrial components or packaging.

The first essential constituent of the hot-melt resins of the invention is the oligomeric and/or polymeric crosslinking agent (B) which is copolymerizable with the solid unsaturated polyester (A).

In the context of the present invention, oligomers are compounds containing on average from 2 to 15 repeating monomer units in the molecule. Polymers are compounds containing on average more than 10 repeating monomer units in the molecule.

The crosslinking agents (B) for use in accordance with the invention have at least one and in

particular at least two isoprenyl, propenyl and/or acrylate groups. Advantageously, at least one, in particular at least two, propenyl and/or isopropenyl groups is or are used. These olefinically unsaturated groups are linked terminally and/or laterally, i.e. pendantly, to the oligomer and/or polymer main chain.

There is no upper limit on the number of these olefinically unsaturated groups in the crosslinking agent (B) for use in accordance with the invention. In accordance with the invention, however, it is advantageous if the number of these groups on average does not exceed 12, with particular preference 10, and in particular 8, per molecule.

The oligomer and/or polymer main chain may be linear, branched in any desired manner, or dendrimeric in structure. Preferably it is formed by saturated and/or unsaturated polyethers, polyester, polyester amides, polyester imides and/or polyurethanes, especially polyesters and/or polyurethanes.

The above-described olefinically unsaturated groups for use in accordance with the invention, especially the propenyl and isopropenyl groups, may be introduced into the said oligomers and polymers by the customary and known methods of organic chemistry and of polymer chemistry. Examples of suitable compounds for introducing these groups are propenyl ethers of polyols, isopropenylbenzyl-m-isopropyl isocyanate, 1-propenyl glycidyl ether, isoprenol, hydroxyalkyl (meth)acrylates, glycidyl (meth)acrylates and isocyanate (meth)acrylates. Numerous compounds of this kind are available on the market. Methods of preparing 1-propenyl ethers are described, for example, in J.V. Crivello et al. in Macromolekular Engineering, Plenum Press, New York, 1995.

Using the abovementioned isocyanates, glycidyl ethers and isoprenol it is possible to synthesize terminally functionalized polymeric compounds. Preference is given to polyesters and polyurethanes

obtainable in accordance with the conventional rules; for example, polyurethanes from isocyanates and compounds reactive therewith, preferably hydroxyl compounds or polyfunctional hydroxyl compounds. When the particularly preferred polyesters are used, the termination of the invention may be achieved by also using the abovementioned compounds, such as isopropenylbenzyl-m-isopropyl isocyanate, 1-propenyl glycidyl ether and isoprenol.

By way of the structure of the crosslinking agents (B) for use in accordance with the invention it is possible to determine the end properties of the cured hot-melt resins within a wide range. Linear crosslinking agents (B) without pendant and with exclusively terminal acrylate isoprenyl and/or propenyl groups produce a more wide-meshed crosslinking with longer network arcs and greater flexibility of the cured hot-melt resins. Highly branched and/or highly pendantly functionalized with crosslinking agents (B) produce a high crosslinking density and, after the curing of the hot-melt resins, hard or else brittle impregnations or coatings.

In addition to the above-described olefinically unsaturated groups which are essential to the invention, the crosslinking agents (B) may also comprise the structural units of the general formula I and/or II described below. These structural units are introduced into the crosslinking agents (B) as described below for the polyesters (A) for use in accordance with the invention.

It is preferred to use oligomeric crystalline or partially crystalline crosslinking agents (B).

In accordance with the invention, particular advantages result from using these oligomeric crystalline or partially crystalline crosslinking agents (B) in combination with highly condensed, solid, unsaturated polyesters (A). Such combinations display the desired melting characteristics (low melting

temperature, low melt viscosity at temperatures in the vicinity of the melting temperature, i.e., a steep course of the curve of viscosity over temperature), a good melt stability even in the presence of catalysts and, after curing, produce particularly heat-stable impregnations and coatings.

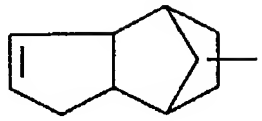
In accordance with the invention, however, it is also of advantage to combine unsaturated polyesters (A) which have lower degrees of condensation and/or have been prepared using monofunctional substances with polymeric crosslinking agents (B).

A further key advantage of the hot-melt resins of the invention is that the weight ratio of polyester (A) to crosslinking agent (B) may be varied very widely, so giving hot-melt resins of the invention with a very wide variety of profiles of properties. By this means it is possible to tailor the hot-melt resins of the invention simply and advantageously to a very wide variety of end uses. Advantageously, the weight ratio (A):(B) is from 5:1 to 1:5, with particular preference from 4:1 to 1:3, with very particular preference from 3:1 to 1:1.5, and in particular from 2.5:1 to 1:1.2. Accordingly, the amount of crosslinking agents (B) for use in accordance with the invention in the hot-melt resins of the invention may vary very widely. In accordance with the invention it is of advantage if the crosslinking agents (B) are present in the hot-melt resins of the invention in an amount, based in each case on the hot-melt resins, of from 2 to 60% by weight, preferably from 3 to 55% by weight, with particular preference from 5 to 50% by weight, and in particular from 7 to 45% by weight.

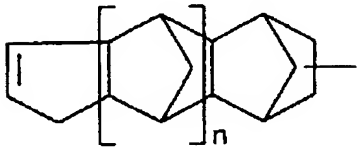
The other essential constituents of the hot-melt resins of the invention are the solid unsaturated polyesters (A).

Examples of suitable polyesters (A) for use in accordance with the invention are polyesters which are known per se and which have structural units of the

general formula I and/or II, which are derived from dicyclopentadiene (DCPD).

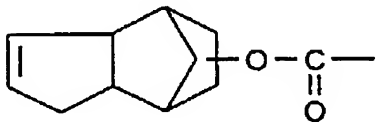


(I)

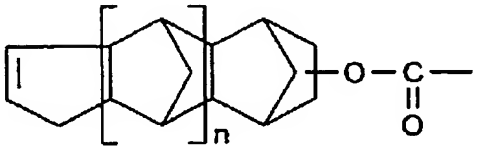


(II), in which the index n is an integer from 1 to 10.

Preferably, these groups are introduced by way of the readily obtainable esterlike DCPD adducts, in accordance with the formulae III and IV, with polycarboxylic acids:

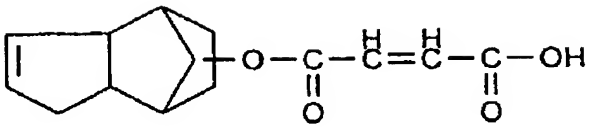


(III)

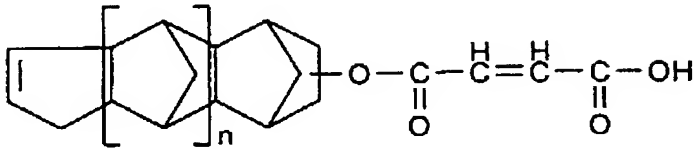


(IV) in which the index n is an integer from 1 to 10.

The adducts of maleic anhydride and water with DCDP, in accordance with the formulae V and VI, are very readily obtainable:

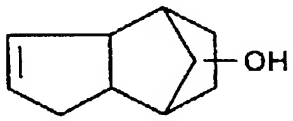


(V)



(VI).

Moreover, dihydrodicyclopentadienol of formula VII is available commercially and may also be used when synthesizing the unsaturated polyesters. Doing so likewise introduces the structures of the formulae I and II and produces unsaturated polyesters (A).



(VII)

The synthesis of the polyesters (A) for use in accordance with the invention takes place by the prior art processes for preparing polyesters, generally by polycondensation of polyfunctional hydroxyl compounds with polyfunctional acids and/or their anhydrides at relatively high temperatures. It may be advantageous to start from the esters of such compounds and to obtain the polyesters (A) by transesterification at relatively high temperatures, since such transesterifications in some cases proceed more readily and more rapidly than direct esterification. The unsaturated nature of the polyesters (A) comes about through the use of

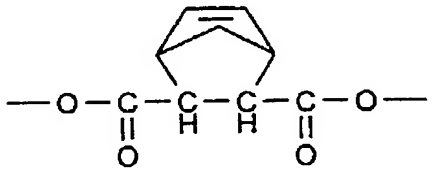
unsaturated compounds in the acid component and/or unsaturated alcohol component, such as, for example, alkenediols and/or alkoxylated alkenediols. Preferably, unsaturated polyester resins (A) are obtained with maleic acid and/or maleic anhydride and/or fumaric acid. These compounds are available industrially at very favorable cost. Moreover, it is also possible, by using polyfunctional amines, to obtain polyesters (A) having amide structures. The use of monofunctional starting materials is also possible in order, for example, to regulate the molecular weight.

Examples of suitable compounds for the synthesis of the unsaturated polyesters (A) are adipic acid, suberic acid, phthalic acid isomers, tetrahydrophthalic acid, endomethylenetetrahydrophthalic acid, hexahydrophthalic acid, fumaric acid, maleic acid, itaconic acid, citraconic acid, trimellitic acid, pyromellitic acid, ethylene glycol, polyethylene glycols, propylene glycol, polypropylene glycols, butanediol isomers, hexanediol, neopentyl glycol, trimethylolpropane, glycerol, pentaerythritol, bisphenol A, trishydroxyethyl isocyanurate (THEIC), OH-polyfunctional polymers, such as hydroxyl-modified polybutadienes or hydroxyl-bearing polyurethane prepolymers and epoxy resins, polyfunctional natural substances or their derivatives, such as linseed oil fatty acid, dimeric and polymeric linseed oil fatty acid, castor oil, and castor oil fatty acid. Hydrogenated bisphenol A (dicyclohexanolpropane) is very suitable for the present invention for synthesizing the polyesters (A) and crosslinking agents (B) since its use produces good blocking resistance of the materials coupled with relatively low melt viscosity. It is also possible to introduce amide and imide structures. The introduction of such structures is known to the person skilled in the art, for example, from German Patents DE-A-15 700 273 and DE-A-17 200 323. Such polyester amides or polyester imides (A) may in many cases meet

particular requirements, in respect of thermal stability, for example, better than do straight polyesters (A).

The introduction of the structural units in accordance with the formulae I and II may take place preferably through the use of acidic esters in accordance with the formulae III to VI during the product condensation. Oligo-DCPD mixtures may be obtained in a manner known per se by polycycloaddition of cyclopentadiene under pressure at temperatures between 170 and 300°C. The reaction products may subsequently be worked up by distillation or reacted directly, with maleic anhydride and water, for example, to the compounds of the formulae V and VI. A further possibility is to prepare polyesters (A) with an excess of acid and then to react them with DCPD. A high conversion requires the use of catalysts, such as boron trifluoride etherate. At higher temperatures and pressure, oligo-DCPD structures are also formed.

Where the polyesters (A) contain double bonds in the polymer chain, as maleic or fumaric esters, for example, grafting with cyclopentadiene produces endomethylenetetrahydrophthalic acid structures in accordance with the formula VIII:



(VIII).

For the particular use intended, specific requirements in respect of hardness, elasticity, viscosity, softening point or the like may be imposed on the polyesters (A) from which the hot-melt resins of the invention have been synthesized. In respect of

these particular requirements, the synthesis of the polyesters (A) then takes place in accordance with rules known per se to the person skilled in the art. For instance, the (partial) crystallinity of the polyesters (A) and the elasticity of cured polyesters (A) are varied by the selection and the chain length of the polyols or polycarboxylic acids. For example, polyesters (A) synthesized using hexanediol or adipic acid are more flexible than those based on phthalic acid and ethylene glycol. Also known to the person skilled in the art is the control of the properties through the use of polyfunctional substances which produce branching in the polyester molecules, such as trimellitic acid or trimethylolpropane.

The amount of polyesters (A) for use in accordance with the invention in hot-melt resins of the invention may vary widely. In this way it is further possible to tailor the profile of properties of the hot-melt resins of the invention to the particular end use, in a simple and advantageous manner. In accordance with the invention it is of advantage if the polyesters (A) are present in the hot-melt resins of the invention in an amount, based in each case on the hot-melt resins, of from 5 to 90% by weight, preferably from 7 to 85% by weight, with particular preference from 9 to 80% by weight, and in particular from 11 to 75% by weight.

The hot-melt resins of the invention may further comprise customary and known additives in effective amounts. Examples of suitable additives are curing accelerators, photoinitiators, pigments and/or fillers.

Examples of suitable curing accelerators are compounds which form free radicals on heating. Examples of known free-radical formers are peroxides, azo compounds, azides and C-C-labile substances, as described in German Patent DE-A-26 32 294. A considerable acceleration of the curing, or reduction

in curing temperature, is obtainable with metal coinitiators such as compounds of cobalt, manganese, iron, nickel or lead.

Examples of suitable photoinitiators are UV initiators of Norrish type 1 or H donor/acceptor systems (Norrish type 2). For further details, reference may be made to Römpp Chemie Lexikon, 9th, expanded and revised edition, Georg Thieme Verlag Stuttgart, Vol. 4, 1991. The UV reactivity of the photoinitiators is particularly high when the unsaturated polyesters (A) and/or the crosslinking agents (B) contain the H-acceptor groups in chemically bonded form. This can be achieved through the use of cocondensable phenone compounds, such as hydroxybenzophenone, bishydroxybenzophenone or benzophenonecarboxylic acids and/or their anhydrides, in the polycondensation of the polyesters (A).

Examples of suitable pigments and/or fillers are examples of suitable inorganic color pigments (D) are titanium dioxide, iron oxides, Sicotrans yellow and carbon black. Examples of suitable organic color pigments are indanthrene blue, Cromophthal red, Irgazine orange and Heliogen green.

Furthermore, the coating material of the invention may comprise organic and inorganic fillers (D) in customary and known, effective amounts. Examples of suitable fillers are chalk, calcium sulphates, barium sulphate, silicates such as talc or kaolin, silicas, oxides such as aluminium hydroxide or magnesium hydroxide, nanoparticles based on silicon dioxide, aluminum oxide or zirconium oxide or organic fillers such as textile fibers, cellulose fibers, polyethylene fibers or wood flour. For further details, reference is made to Römpp Lexikon "Lacke und Druckfarben" Georg Thieme Verlag, Stuttgart, 1998, pages 250 to 252;

Further examples of suitable additives are described in the text book "Lackadditive" [Coatings

additives] by Johan Bieleman, Wiley-VCH, Weinheim, New York, 1998.

The amount of the above-described additives in the hot-melt resins of the invention may vary very widely and is guided primarily by their function. The person skilled in the art will therefore be able easily to determine the appropriate amount of additives in each case, on the basis of his or her technical knowledge, with or without the aid of simple rangefinding tests. For example, the curing accelerators may be present in an amount of up to 15% by weight, the photoinitiators in an amount of up to 10% by weight and the pigments and/or fillers in an amount of up to 90% by weight, based in each case on the hot-melt resin of the invention.

The preparation of the hot-melt resins of the invention in their ready-to-use formulations has no special features as to its method but instead takes place by mixing melts of the constituents (A) and (B) and, if desired, of the additives. The melts may be run off into appropriate transport containers or, preferably, discharged in melt form and then converted by known techniques into granules, pillets or flakes. In addition, it is of interest to convert the melts into shaped parts adapted in their form and size to the components to be impregnated, to the absorbent substances to be impregnated or to the primed and unprimed substrates to be coated, these parts being placed, for example, onto the components, absorbent substances or substrates and being able by heating to flow into or over these components, substances or substrates. The hot-melt resins of the invention do not require the use of wax to obtain blocking-resistant, component-specific moldings, which is a further particular advantage of the hot-melt resins of the invention.

Otherwise, the hot-melt resins of the invention, after they have been melted, may be applied

by dipping, hot-dipping, dip-rolling, flooding, casting, vacuum impregnation, vacuum pressure impregnation or trickling onto and into the optionally preheated components, especially the electronic components, onto and into the optionally preheated absorbent substances, especially the glass silk or mica tapes, or to the primed or unprimed substrates to be coated, especially the vehicle body parts provided with an electrodeposition coating, or the packaging, or the plastics parts provided with a water-based primer.

Also possible is an application in the manner of polymer injection molding, in which case the component to be insulated is implemented in the injection mold. Thus it is possible, for example, to mass-produce small parts rapidly.

Melting may take place, for example, in the course of flow through a heat exchanger. Preference is given to combinations of melting devices and integrated and/or downstream mechanical conveyance, e.g. metering melt screw devices (extruders).

The applied hot-melt resins may be partly gelled before actual curing. This has the advantage that dripping losses can be avoided.

In accordance with the invention, the resins are cured by thermal curing by means of electricity, induction, hot fluids, especially hot inert gases, microwave radiation and/or IR radiation, especially near infrared (NIR) radiation. Particular advantages result from the use of IR radiation and especially NIR (approximately 700 - 1300 nm). It is also possible to use any desired combination and sequence of the abovementioned methods for curing.

In accordance with the invention, the hot-melt resins of the invention may also be cured with actinic radiation. Suitable actinic radiation includes electromagnetic radiation and/or corpuscular radiation. UV light (electromagnetic radiation) and/or electron

beams (corpuscular radiation) are particularly suitable.

In accordance with the invention it is before part to combine the two curing methods with one another.

For example, the applied hot-melt resins of the invention may first be surface-cured with UV light and then cured to completion, with heating, using compounds which on heating produce free radicals.

In the field of electrical insulation, curing takes place by exposure to high-energy radiation, preferably UV light, or by means of heat, preferably oven heating and/or IR heating, especially by NIR. With particular preference, combined curing with UV light and/or NIR and heat is employed. A technical advantage of the hot-melt resins of the invention in this respect is their high UV and heat reactivity at comparatively low temperatures of below 180°C, preferably below 140°C. This is in association with good melt stability at temperatures only slightly below the reaction temperature. This ensures that the hot-melt resins can be prepared and applied from the melt without premature reaction and without the electrical components being destroyed by high temperatures during the curing of their insulating compositions. Moreover, the electronic components may be produced rapidly in rational mass production, since curing is rapid. These advantages also result in the context of the use of the hot-melt resins of the invention in the other above-described technological fields.

Also of very particular importance is the use of NIR, since it penetrates deep into the applied hot-melt resins of the invention and thus brings about rapid and uniform heating with only a small temperature difference over the thickness of the coat, and so permits the curing even of thick coats without heating the component, the absorbent material or the substrate as a whole. Longwave IR radiation is absorbed

substantially at the surface, with in-depth heating being possible only by way of slow heat flux; in other words, a large temperature difference is produced with the consequence of non-uniform curing over the thickness of the coat.

The abovementioned curing processes may also be performed until a B stage, i.e. a part-cured stage is reached. Subsequently, curing is interrupted and can be recommenced at a later point.

A curing process which is especially advantageous for electrical insulating hot-melt resins consists in first carrying out surface curing with UV light and then carrying out further curing, with heating, using substances which on heating produce free radicals. If the hot-melt resins of the invention are to be used as casting and impregnating compositions, i.e. for preparing insulating compositions in electrical windings, the insulating composition in the interior of the electronic components is first of all cured in whole or in part by means of Joule heat. Subsequently, a surface which may have cured poorly is aftercured or postcrosslinked with IR radiation, preferably NIR radiation and/or UV light, the insulating composition in the interior of the windings also being crosslinked further, possibly, by means of heat.

A further end use for the hot-melt resins of the invention is in the insulation and protection against mechanical abrasion of, for example, the winding head of hi-speed DIY power tools. For this purpose, the already insulated windings, heated very highly by means of Joule heat, are subjected to resin powder in a fluidized bed, for example, in the course of which a resin coat that can be determined by means of the preheating is sintered on, and crosslinked.

The articles of the invention that are impregnated or coated with the cured hot-melt resins of the invention have a much longer surface life than

conventional components, insulating materials and substrates and have a more advantageous profile of properties, so making them more valuable - from an economic standpoint, too - for the user. For instance, the components of the invention, especially the electronic components of the invention, are superior to the conventional components in respect, inter alia, of freedom from tack, freedom from cracks, hardness and abrasion resistance, for example. The insulating materials of the invention have a greater weathering stability and are therefore suitable inter alia for applications under extreme climatic conditions (maritime, tropical or polar climate). The same applies to the substrates of the invention, especially the vehicle body parts, packaging or industrial components of the invention such as wheel rims, radiators or runners subject to particular heat, moisture and/or radiation stresses.

Examples

Preparation Example 1

The preparation of the compound 1 (monocarboxylic acid of formula V)

710.81 g of 93% dicyclopentadiene (5.0 mol)
490.30 g of maleic anhydride (5.0 mol)
are weighed out into a stirring flask with heating and reflux condenser. The mixture is heated to 125°C under a gentle stream of nitrogen and then
95.00 g of water 5.0 mol + 5 g (5.0 mol + 5 g)
are added from a dropping funnel over the course of one hour. The mixture is left to react at 125°C for one hour. A monocarboxylic acid of formula V is formed.

Preparation Example 2

The preparation of the unsaturated polyester (A)

1344.00 g of dicyclohexanolpropane
1033.60 g of compound 1 from Preparation Example 1
235.20 g of maleic anhydride

278.40 g of fumaric acid
630.00 g of Polyol TP 70 (1 mol trimethylolpropane + 7 mol ethylene oxide)
34.00 g of hypophosphorous acid, 50% strength (esterification catalyst)
0.50 g of hydroquinone
are weighed out into a stirring flask with heating and top-mounted distillation unit. The mixture is heated rapidly to 130°C under a gentle stream of nitrogen. Then the temperature is raised gradually to 190°C over the course of 41/2 hours, during which the water of condensation which forms is removed by distillation. Then a vacuum is applied and the temperature is held at 190°C for three hours more. This gives a resin melt which is cast onto aluminum foil and solidifies to give a hard, blocking-resistant resin. The resin has an acid number of 14.7 and melt viscosities of 158 Pas/120°C; 73 Pas/130°C; 46 Pas/140°C.

Preparation Example 3
The preparation of a polyester-based crosslinking agent (B) terminated with isoprenol ester
1753.7 g of adipic acid (6.0 mol)
478.6 g of isoprenol (5.5 mol)
368.4 g of dicyclohexanolpropane (2 mol)
261.7 g of THEIC (trishydroxyethyl isocyanurate) (1 mol)
400.0 g of toluene
6.0 g of Fascat 4201 (tin catalyst)
(0.5 equivalent HO excess) are weighed out into a stirring vessel with heating and water separator. The mixture is heated rapidly to 130°C under a gentle stream of nitrogen. Water is then separated off with vigorous boiling. After about 3 hours, the formation of water subsides. Then the temperature is raised gradually to 190°C over the course of approximately 2 hours, during which the toluene unreacted isoprenol and some additional water are removed by distillation. Then

a vacuum is applied and condensation is continued at 190°C for 4 hours.

This gives a resin melt which is passed onto aluminum foil and solidifies to give a hard, blocking-resistant resin. The resin has an acid number of 17.2 and melt viscosities of 6.28 Pas/120°C; 4.71 Pas/130°C; 2.21 Pas/140°C.

Preparation Example 4

The preparation of a polyurethane-based crosslinking agent (B) terminated with acrylic ester/isoprenyl

296.3 g of hexanediol (2.5 mol)
4064.2 g of hydroxyethyl acrylate (2.5 mol)
1033.6 g of isoprenol (3.5 mol)
1504.8 g of MDI (5.5 mol)

The hydroxyl components are charged to a stirring flask and at approximately 70°C MDI is added over 30 minutes with stirring, during which the temperature is raised to 120°C; it is held at 120°C for a further 20 minutes and then the resultant melt is cast onto aluminum foil. After cooling, a hard, blocking-resistant resin is obtained.

The resin has a melt viscosities of 2.16 Pas/120°C; 1.97 Pas/130°C; 0.94 Pas/140°C.

Example 1

The preparation of a hot-melt resin of the invention

680 g of the polyester resin (A) from Preparation Example 2
320 g of the crosslinking agent (B) from Preparation Example 3
30 g of dicumylperoxide (DCPO)
10 g of Härter BK (benzpinacol curing agent, BAYER)
3 g of hydroquinone monomethyl ether
10 g of benzophenone
25 g of benzoin

are mixed in a hammer mill, ground and homogenized at 94°C in a laboratory extruder, with a residence time of 6 minutes. The discharge from the extruder is collected on sheet aluminum and after cooling is ground.

Example 2

The preparation of a hot-melt resin of the invention

The procedure of Example 2 is repeated except that the crosslinking agent (B) from Preparation Example 4 is used rather than the crosslinking agent (B) from Preparation Example 3.

Example 3

The testing of the hot-melt resins of Examples 2 and 3 for melt behavior and reactivity (gel time)

Samples of the hot-melt resins of Examples 2 and 3 are melted in the plate/plate measuring apparatus of a programmable rheometer (from Physica) at approximately 90°C under oscillating shear, the temperature is then raised to 105°C, and the time is measured at which the resin gels, i.e. the viscosity curve rapidly rises very steeply (gel time). With a further sample, starting at 100°C, a heating rate of 10 K/min is applied and the temperature is measured at which the resin gels (onset temperature).

The results of the measurement are given in the table.

Table: Melting behavior and reactivity of the hot-melt resins of the invention from Examples 2 and 3

Example	Gel time [min]	Onset temperature [°C]
2	122	142
3	67	128

To test the hot-melt resins of the invention from Examples 2 and 3 for their curing behavior, samples of the resin powders 2 and 3 were weighed out

into deep metal lids in an amount such that the thickness after melting was 10 mm. The powder-filled metal lids are subjected to melting in an oven at 105°C for 10 minutes to give substantially bubble-free resins 2 and 3. The metal lids containing the melts 2 and 3 are then irradiated on a plate preheated to 110°C under a mercury vapor lamp with an energy of 14 mJ/cm2 for 5 minutes, forming an almost tack-free skin on the resin surface. After irradiation, the metal lids are subjected to curing in the oven at 140°C in 20 minutes. This gives hard, crack-free resin blocks 2 and 3. The mass losses in the course of the curing process are < 1% for both resins.

Hot-melt resins and their use

Claims

1. Hot-melt resins comprising

A) at least one solid unsaturated polyester and

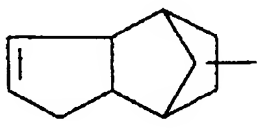
B) at least one oligomeric and/or polymeric crosslinking agent which is copolymerizable with the said polyester and which in respect of the oligomeric and/or polymeric main chain comprises at least one terminal and/or pendant propenyl, isopropenyl and/or (meth)acrylic ester group.

2. The hot-melt resins as claimed in claim 1, characterized in that the crosslinking agents (B) have at least two terminal and/or pendant propenyl, isopropenyl and/or (meth)acrylic ester groups.

3. The hot-melt resins as claimed in claim 1 or 2, characterized in that the crosslinking agents (B) have propenyl and/or isopropenyl groups.

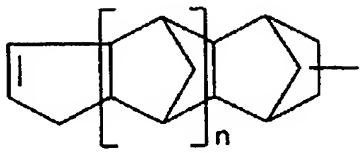
4. The hot-melt resins as claimed in one of claims 1 to 3, characterized in that the oligomer and polymer main chains are formed by saturated and/or unsaturated polyesters, polyester amides, polyester imides and/or polyurethanes.

5. The hot-melt resins as claimed in one of claims 1 to 4, characterized in that at least one of the unsaturated polyesters (A) and/or at least one of the crosslinking agents (B) has at least one structural unit of the general formula I



(I)

and/or at least one structural unit of the general formula II



(II) in which the index n is an integer from 1 to 10.

6. The hot-melt resins as claimed in one of claims 1 to 5, characterized in that they comprise additives, especially curing accelerators, photoinitiators, especially of Norrish type 1 or 2, pigments and/or fillers.

7. The hot-melt resins as claimed in claim 6, characterized in that the photoinitiators are bonded chemically to at least one of the unsaturated polyesters (A) and/or at least one of the crosslinking agents (B).

8. The use of the hot-melt resins as claimed in one of claims 1 to 7 as casting and impregnating compositions or coating materials.

9. The use of the hot-melt resins as claimed in claim 8, characterized in that they are used as casting and impregnating compositions for components and for impregnating absorbent materials and also as coating materials for primed and unprimed substrates.

10. The use of the hot-melt resins as claimed in claim 9, characterized in that the components comprise electronic components, the absorbent materials comprise sheetlike insulating materials, especially glass silk and mica tapes, and the primed and unprimed substrates comprise vehicle body parts, industrial components or packaging, especially of metal and/or plastic.

11. A process for the melt impregnation or melt coating of components, absorbent materials or primed and unprimed substrates by

(i) melt-applying a hot-melt resin,

(ii) applying the resultant resin melt onto and into the components, absorbent materials or primed or unprimed substrates,

(iii) curing the applied resin melt by heat and/or actinic radiation,

characterized in that the hot-melt resin comprises

A) at least one solid unsaturated polyester and

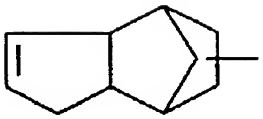
B) at least one oligomeric and/or polymeric crosslinking agent which is copolymerizable with the said polyester and which in respect of the oligomeric and/or polymeric main chain comprises at least one terminal and/or pendant propenyl, isopropenyl and/or (meth)acrylic ester group.

12. The process as claimed in claim 12, characterized in that the crosslinking agents (B) have at least two terminal and/or pendant propenyl, isopropenyl and/or (meth)acrylic ester groups.

13. The process as claimed in claim 11 or 12, characterized in that the crosslinking agents (B) have propenyl and/or isopropenyl groups.

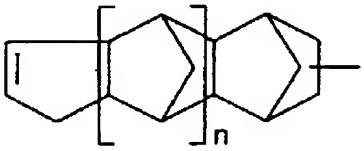
14. The process as claimed in one of claims 11 to 13, characterized in that the oligomer and polymer main chains are formed by linear, branched and/or dendrimeric, saturated and/or unsaturated polyesters, polyester amides, polyester imides and/or polyurethanes.

15. The process as claimed in one of claims 11 to 14, characterized in that at least one of the unsaturated polyesters (A) and/or at least one of the crosslinking agents (B) has at least one structural unit of the general formula I



(I)

and/or at least one structural unit of the general formula II



(II) in which the index n is an integer from 1 to 10.

16. The process as claimed in one of claims 11 to 15, characterized in that they comprise additives, especially curing accelerators, photoinitiators, especially of Norrish type 1 or 2, pigments and/or fillers.

17. The process as claimed in claim 16, characterized in that the photoinitiators are bonded chemically to at least one of the unsaturated polyesters (A) and/or at least one of the crosslinking agents (B).

18. The process as claimed in one of claims 11 to 17, characterized in that the application (ii) takes place by

- placing at least one shaped part comprising the hot-melt resin and adapted in its shape to the shape of the component, absorbent material or primed and unprimed substrate to be coated onto the component, absorbent material or primed and unprimed substrate, and melting the shaped part,

or by

- dipping, hot-dipping, dip-rolling, flooding, casting, vacuum impregnation, vacuum pressure impregnation or trickling.

19. The process as claimed in one of claims 11 to 18, characterized in that the applied hot-melt resin is partially gelled (process step iv) before process step (iii).

20. The process as claimed in one of claims 11 to 19, characterized in that the applied hot-melt resin in process step (iii) is cured by thermal curing by means of electricity, induction, hot fluids, especially hot gases, microwave radiation and/or IR radiation, especially near infrared (NIR) radiation.

21. The process as claimed in one of claims 11 to 20, characterized in that the applied hot-melt resin in process step (iii) is cured electromagnetic radiation, especially UV radiation, and/or corpuscular radiation, especially electron beams.

22. Components, especially electrical components, sheetlike insulating materials based on absorbent materials, and primed and unprimed substrates comprising at least one hot-melt resin, cured thermally and/or with actinic radiation, as claimed in one of claims 1 to 10.

23. The components, especially the electronic components, the sheetlike insulating materials based on absorbent materials and the primed and unprimed substrates as claimed in claim 22, characterized in that the hot-melt resins have been applied and cured with the aid of the process as claimed in one of claims 11 to 21.

ABSTRACT

The invention relates to cast resins containing A) at least one solid unsaturated polyester and B) at least one oligomer and/or polymer cross-linking agent that can be copolymerised therewith, said cross-linking agent having at least one terminal and/or lateral propenyl-, isoprenyl- and/or (meth)acrylester group in relation to the oligomer- and/or polymer main chain. The invention also relates to the use of cast resins as casting beans and impregnants and as coating agents. The invention further relates to a method for melt impregnating or melt coating components, absorbent mattes or grounded or ungrounded substrates with the cast resins.

FOR UTILITY/DESIGN
CIP/PCT NATIONAL/PLANT
ORIGINAL/SUBSTITUTE/SUPPLEMENTAL
DECLARATIONS

RULE 63 (37 C.F.R. 1.63) PW
DECLARATION AND POWER OF ATTORNEY FORM
FOR PATENT APPLICATION
IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

As a below named inventor, I hereby declare that my residence, post office address and citizenship are as stated below next to my name, and I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the INVENTION ENTITLED HOT-MELT RESINS AND THEIR USE

the specification of which (CHECK applicable BOX(ES))

X A. ☐ is attached hereto.

BOX(ES) → B. ☒ was filed on February 21, 2002 as U.S. Application No. 10/069,020

→ C. ☐ was filed as PCT International Application No. PCT/ / on

and (if applicable to U.S. or PCT application) was amended on

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above. I acknowledge the duty to disclose all information known to me to be material to patentability as defined in 37 C F R. 1 56 Except as noted below, I hereby claim foreign priority benefits under 35 U.S.C. 119(a)-(d) or 365(b) of any foreign application(s) for patent or inventor's certificate, or 365(a) of any PCT International Application which designated at least one other country than the United States, listed below and have also identified below any foreign application for patent or inventor's certificate, or PCT International Application, filed by me or my assignee disclosing the subject matter claimed in this application and having a filing date (1) before that of the application on which priority is claimed, or (2) if no priority claimed, before the filing date of this application:

PRIOR FOREIGN APPLICATION(S) Number	Country	Day/MONTH/Year Filed	Date first Laid-open or Published	Date Patented or Granted	Priority NOT Claimed
19939759.7	DE	21/Aug/1999			

If more prior foreign applications, X box *at bottom* and continue on attached page.

Except as noted below, I hereby claim domestic priority benefit under 35 U S C 119(e) or 120 and/or 365(c) of the indicated United States applications listed below and PCT international applications listed above or below and, if this is a continuation-in-part (CIP) application, insofar as the subject matter disclosed and claimed in this application is in addition to that disclosed in such prior applications, I acknowledge the duty to disclose all information known to me to be material to patentability as defined in 37 C F R 1 56 which became available between the filing date of each such prior application and the national or PCT international filing date of this application:

PRIOR U.S. PROVISIONAL, NONPROVISIONAL AND/OR PCT APPLICATION(S) Application No. (series code/serial no.)	Day/MONTH/Year Filed	Status pending, abandoned, patented	Priority NOT Claimed
PCT/EP00/07381	31/July/2000		

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

And I hereby appoint Pillsbury Winthrop LLP, Intellectual Property Group, telephone number (703) 905-2000 (to whom all communications are to be directed), and persons of that firm who are associated with USPTO Customer No 909 (see below label) individually and collectively my attorneys to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith and with the resulting patent, and I hereby authorize them to delete from that Customer No names of persons no longer with their firm, to add new persons of their Firm to that Customer No., and to act and rely on instructions from and communicate directly with the person/assignee/attorney/firm/ organization who/which first sends/sent this case to them and by whom/which I hereby declare that I have consented after full disclosure to be represented unless/until I instruct the above Firm and/or an attorney of that Firm in writing to the contrary

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☒ FOR ADDITIONAL INVENTORS see attached page.

☐ See additional foreign priorities on attached page (incorporated herein by reference).

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RULE 63 (37 C.F.R. 1.63)
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FOR PATENT APPLICATION
IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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FORM

As a below named inventor, I hereby declare that my residence, post office address and citizenship are as stated below next to my name, and I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the **INVENTION ENTITLED HOT-MELT RESINS AND THEIR USE**

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☐ See additional foreign priorities on attached page (incorporated herein by reference).

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(M#)

DECLARATION AND POWER OF ATTORNEY
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City	State/Foreign Country		Country of Citizenship
Post Office Address	Bernadottestr. 54, Hamburg, Federal Republic of Germany		
(include Zip Code)	D-22763		

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Post Office Address			
(include Zip Code)			

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(include Zip Code)			

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Post Office Address			
(include Zip Code)			

DECLARATION AND POWER OF ATTORNEY
(continued)
ADDITIONAL INVENTORS

(3) INVENTOR'S SIGNATURE: X [signature] Date: X 26.04.2002

First	Middle Initial	Family Name
Gunther		HEGEMANN

Residence	City	State/Foreign Country	Country of Citizenship
	Hamburg	Federal Republic of Germany DEX	Germany

Post Office Address	Andreasstr. 23, Hamburg, Federal Republic of Germany
(include Zip Code)	D-22301

(4) INVENTOR'S SIGNATURE: Date:

First	Middle Initial	Family Name
Klaus-Wilhelm		LIENERT

Residence	City	State/Foreign Country	Country of Citizenship
	Hamburg	Federal Republic of Germany	Germany

Post Office Address	Bernadottestr. 54, Hamburg, Federal Republic of Germany
(include Zip Code)	D-22763

(5) INVENTOR'S SIGNATURE: Date:

First	Middle Initial	Family Name

Residence	City	State/Foreign Country	Country of Citizenship

Post Office Address	
(include Zip Code)	

(6) INVENTOR'S SIGNATURE: Date:

First	Middle Initial	Family Name

Residence	City	State/Foreign Country	Country of Citizenship

Post Office Address	
(include Zip Code)	

(7) INVENTOR'S SIGNATURE. Date:

First	Middle Initial	Family Name

Residence	City	State/Foreign Country	Country of Citizenship

Post Office Address	
(include Zip Code)	

(8) INVENTOR'S SIGNATURE. Date:

First	Middle Initial	Family Name

Residence	City	State/Foreign Country	Country of Citizenship

Post Office Address	
(include Zip Code)	

(9) INVENTOR'S SIGNATURE. Date:

First	Middle Initial	Family Name

Residence	City	State/Foreign Country	Country of Citizenship

Post Office Address	
(include Zip Code)	

FOR UTILITY/DESIGN
CIP/PCT NATIONAL/PLANT
ORIGINAL/SUBSTITUTE/SUPPLEMENTAL
DECLARATIONS

RULE 63 (37 C.F.R. 1.63)
DECLARATION AND POWER OF ATTORNEY
FOR PATENT APPLICATION
IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

PW
FORM

As a below named inventor, I hereby declare that my residence, post office address and citizenship are as stated below next to my name, and I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the **INVENTION ENTITLED HOT-MELT RESINS AND THEIR USE**

the specification of which (CHECK applicable BOX(ES))

X BOX(ES) →
A. ☐ is attached hereto
→ B. ☒ was filed on February 21, 2002 as U.S. Application No. 10/069,020
→ C ☐ was filed as PCT International Application No. PCT/ / on

and (if applicable to U.S. or PCT application) was amended on

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above. I acknowledge the duty to disclose all information known to me to be material to patentability as defined in 37 C F.R. 1.56. Except as noted below, I hereby claim foreign priority benefits under 35 U S C 119(a)-(d) or 365(b) of any foreign application(s) for patent or inventor's certificate, or 365(a) of any PCT International Application which designated at least one other country than the United States, listed below and have also identified below any foreign application for patent or inventor's certificate, or PCT International Application, filed by me or my assignee disclosing the subject matter claimed in this application and having a filing date (1) before that of the application on which priority is claimed, or (2) if no priority claimed, before the filing date of this application.

PRIOR FOREIGN APPLICATION(S) Number	Country	Day/MONTH/Year Filed	Date first Laid-open or Published	Date Patented or Granted	Priority NOT Claimed
19939759.7	DE	21/Aug/1999			

If more prior foreign applications, X box *at bottom* and continue on attached page.

Except as noted below, I hereby claim domestic priority benefit under 35 U S C. 119(e) or 120 and/or 365(c) of the indicated United States applications listed below and PCT international applications listed above or below and, if this is a continuation-in-part (CIP) application, insofar as the subject matter disclosed and claimed in this application is in addition to that disclosed in such prior applications, I acknowledge the duty to disclose all information known to me to be material to patentability as defined in 37 C.F R 1 56 which became available between the filing date of each such prior application and the national or PCT international filing date of this application:

PRIOR U.S. PROVISIONAL, NONPROVISIONAL AND/OR PCT APPLICATION(S) Application No. (series code/serial no.)	Day/MONTH/Year Filed	Status pending, abandoned, patented	Priority NOT Claimed
PCT/EP00/07381	31/July/2000		

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

And I hereby appoint Pillsbury Winthrop LLP, Intellectual Property Group, telephone number (703) 905-2000 (to whom all communications are to be directed), and persons of that firm who are associated with USPTO Customer No. 909 (see below label) individually and collectively my attorneys to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith and with the resulting patent, and I hereby authorize them to delete from that Customer No names of persons no longer with their firm, to add new persons of their Firm to that Customer No , and to act and rely on instructions from and communicate directly with the person/assignee/attorney/firm/ organization who/which first sends/sent this case to them and by whom/which I hereby declare that I have consented after full disclosure to be represented unless/until I instruct the above Firm and/or an attorney of that Firm in writing to the contrary.

USE ONLY FOR
PILLSBURY WINTHROP

00909

(1) **INVENTOR'S SIGNATURE:** Date:

Name	Rainer		BLUM
	First	Middle Initial	Family Name
Residence	Ludwigshafen	Federal Republic of Germany	Germany
	City	State/Foreign Country	Country of Citizenship
Mailing Address	Rudigerstrasse 64, Ludwigshafen, Federal Republic of Germany		
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(2) **INVENTOR'S SIGNATURE:** Date:

Name	Manfred		EICHHORST
	First	Middle Initial	Family Name
Residence	Oststeinbek	Federal Republic of Germany	Germany
	City	State/Foreign Country	Country of Citizenship
Mailing Address	Am Ohlendiek 18, Oststeinbek, Federal Republic of Germany		
(include Zip Code)	D-22113		

☒ FOR ADDITIONAL INVENTORS see attached page.
☐ See additional foreign priorities on attached page (incorporated herein by reference).

Atty. Dkt. No. P290586
(M#)

DECLARATION AND POWER OF ATTORNEY
(continued)
ADDITIONAL INVENTORS

(3) INVENTOR'S SIGNATURE: Date:

First	Middle Initial	Family Name
Gunther		HEGEMANN

Residence City	Federal Republic of Germany State/Foreign Country	Germany Country of Citizenship
Hamburg		

Post Office Address	Andreasstr. 23, Hamburg, Federal Republic of Germany
(include Zip Code)	D-22301

(4) INVENTOR'S SIGNATURE: X Klaus-W. Lienert Date: X April 25th 2002

First	Middle Initial	Family Name
Klaus-Wilhelm		LIENERT

Residence City	Federal Republic of Germany DEX State/Foreign Country	Germany Country of Citizenship
Hamburg		

Post Office Address	Bernadottestr. 54, Hamburg, Federal Republic of Germany
(include Zip Code)	D-22763

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Residence City	State/Foreign Country	Country of Citizenship

Post Office Address	
(include Zip Code)	

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the specification of which (CHECK applicable BOX(ES))

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USE ONLY FOR
PILLSBURY WINTHROP

00909

(1) **INVENTOR'S SIGNATURE:** Date:

Name	Rainer		BLUM
	First	Middle Initial	Family Name
Residence	Ludwigshafen	Federal Republic of Germany	Germany
	City	State/Foreign Country	Country of Citizenship
Mailing Address	Rudigerstrasse 64, Ludwigshafen, Federal Republic of Germany		
(include Zip Code)	D-67069		

(2) **INVENTOR'S SIGNATURE:** Date:

Name	Manfred		EICHHORST
	First	Middle Initial	Family Name
Residence	Oststeinbek	Federal Republic of Germany	Germany
	City	State/Foreign Country	Country of Citizenship
Mailing Address	Am Ohlendiek 18, Oststeinbek, Federal Republic of Germany		
(include Zip Code)	D-22113		

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Atty. Dkt. No. P290586
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